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The first observation of Arctic char in glacial river of Austre Brøggerbreen (Ny-Ålesund, Svalbard, Norway)

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ABSTRACT

An anadromous Arctic char was observed in glacial river of Austre Brøggerbreen in northwest Svalbard (Norway) on 9th of July 2017. The young fish, ca. 14,5 cm in length, was caught in shallow part of glacial river in the distance of 1390 m to glacier forehead, and then was released. This is the second observation of Arctic char in glacial river in Svalbard since 2008, and first for Kongsfjorden region.

1. Introduction

Arctic char (*Salvelinus alpinus* L., *Salmonidae*, *Teleostei*) is a northern, circumpolar, palearctic salmonid which occurs widely in Northern Hemisphere in inshore marine waters, lakes and rivers (Maitland, 1995; Heasman and Black, 1998). In Svalbard (Norwegian archipelago located north of mainland Europe in the Arctic Ocean), it is the only freshwater native fish. It is rather commonly distributed and differentiated into two forms: landlocked and anadromous (Overrein and Prestrud, 2006). Due to specific condition of Svalbard ecosystems, the primary production in lakes is considered to be the lowest in the world (Gulseth and Nilssen, 2000). Because of that, Arctic char developed strategy to migrate from ultra-oligotrophic lakes to marine environments more abundant with food organisms (Nilssen and Gulseth, 1998). Concerning the presence of Arctic char in glacial river, only Ziaja (2014) observed upper stream migration of one male in glacial Bungeelva glacial river (Sørkapp Land, S Svalbard). Glacial rivers are suggested to offer conditions unfavourable to fishes for living, such as limited water transparency or steeps rise in various part of stream preventing migration further upstream (Gullestad and Klemsten, 1997; Ziaja, 2014).

2. Material and methods

Observation of Arctic char in glacial river was made in front of Austre Brøggerbreen foreland located in Kongsfjorden region (NW Svalbard) on 9th of July 2017 (Fig. 1A). Fish was shortly pulled out of water for photography documentation and then released (Fig. 1B). Following publications were used to identify the individual: Johnson (1980), Vecsei et al. (2015), Coad and Reist (2018).

3. Result and discussion

The Arctic char was observed and caught in the glacial river of Austre Brøggerbreen during its upstream migration (Fig. 1B). It was noticed in very shallow part of river creek (of depth ca. 15 cm) in the distance of ca. 1400 m to glacier forehead and ca. 2800 m to the river estuary (Figs. 1B and 2 A-C). The Arctic char was silvery individual with blue shading on the back and upper sides, a white belly and bright orange fins (Fig. 2C–E). It was ca. 14,5 cm in length and no scars were observed on the fish body (Fig. 2 E). Comparing to observation made by Ziaja (2014) ca. 270 km south from Ny-Ålesund, fish observed was younger, smaller and in good physical condition. Male caught by Ziaja (2014) was 46 cm in length and dazed by rocky material carried by river.

It is hard to indicate the final destination of migration of observed fish; however according to the map the nearest potential habitat of the anadromous Arctic char is Tvillingvatnet pond (Fig. 1A and B). Tvillingvatnet served as the water supply for the village of Ny-Ålesund (Laybourn-Parry and Marshall, 2003). It is located in the vicinity of Austre Brøggerbreen (ca. 1400 m), Vestre Brøggerbreen (ca. 1800 m) and Vestre Lovénbreen (ca. 2500 m). Haldorsen et al. (2002) suggest that location of pond which is surrounded by three glaciers which cool ambient air and cause cold winds, is the main cause of the low water and

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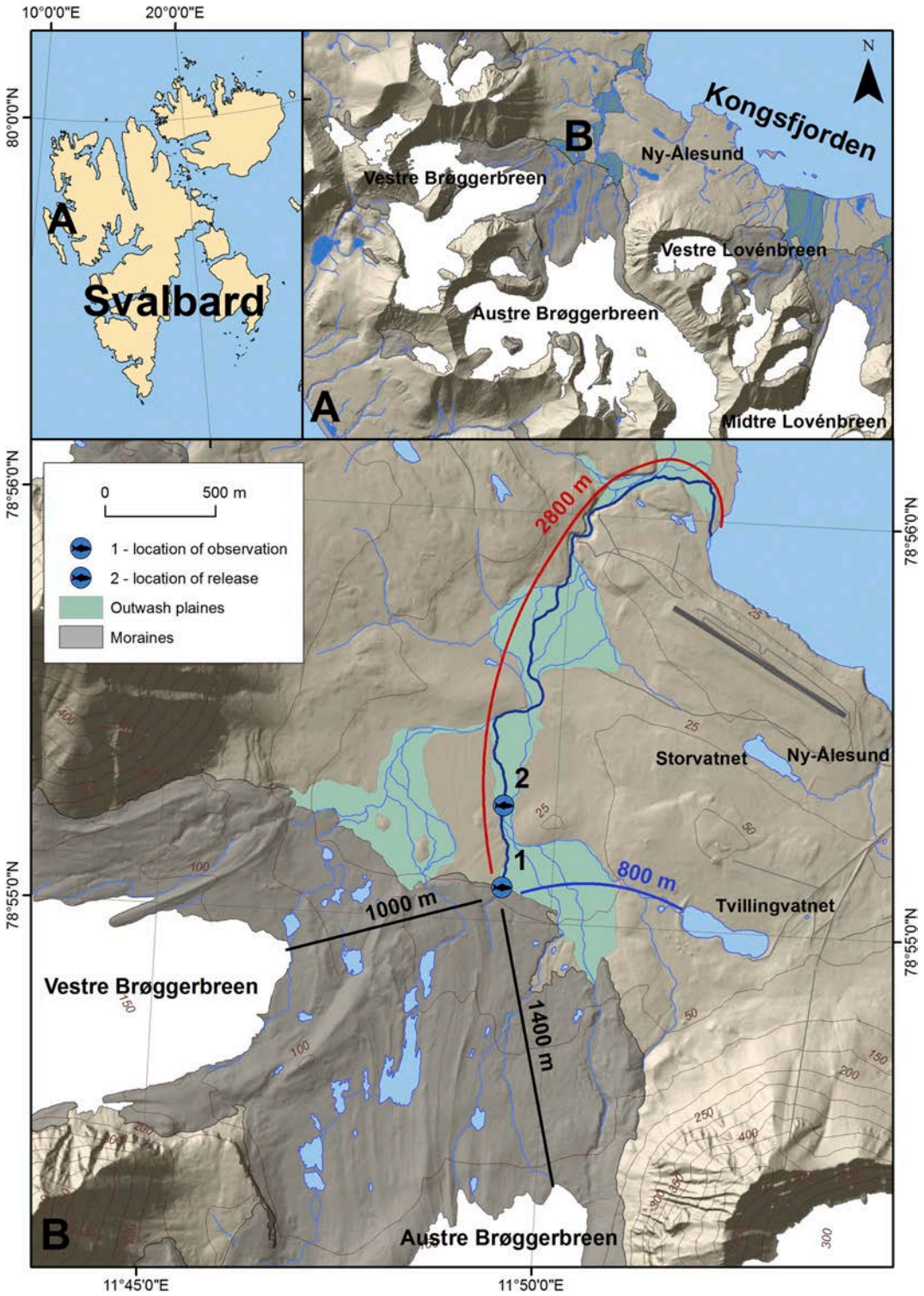

Fig. 1. Location of study area: A) Kongsfjorden region; B) place of Arctic char observation in front of Austre Brøggerbreen; 1) coordinates of Arctic char catching: 78° 55′ 5,022″ N, 11° 49′ 22,08″ E; 2) coordinates of Arctic char releasing: 78° 55′ 16,662″ N, 11° 49′ 16,518″ E (© Norwegian Polar Institute, 2019).

sediment temperatures observed in late season in this pond. It is also the only pond constantly connected to glacial river of Austre Brøggerbreen (Fig. 1A and B). It seems to be that, observed fish may migrate to the Tvillingvatnet as the only possible freshwater reservoir in Brøggerdalen, and had lost its orientation due to muddy conditions of river. The distance between location of fish observation and Tvillingvatnet pond is ca. 800 m. (Fig. 1B). Similarly, distance from fish observation to terminus of Austre Brøggerbreen is ca. 1400 m, while to river estuary is ca. 2800 m (Fig. 1B). Up until 2003 no individuals of any fish species were recorded in the Tvillingvatnet pond (Laybourn-Parry and Marshall, 2003). However, as the anadromous Arctic char living in Svalbard is known to inhabit lakes with the lowest primary production in the world (Gulseth and Nilssen, 2000) and migrate to the sea where food is abundant in summer season, there is a need for study of Tvillingvatnet pond in terms of fish occurrence. Other possible reason for Arctic char to migrate upstream of glacial river was indicated by Ziaja (2014) as example of fish

Fig. 2. Photographical documentation of Arctic char catching: A) view on the glacial river stream where fish was observed; B) view on the glacial river stream where fish was released; C) Arctic char observed in shallow river creek - place in the photo A indicated by red arrow; D) view from top on individual – scale 1 cm; E) view from side on individual – scale 1 cm. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

expansion to new potential habitats as this species is cold-adapted specialist showing great tolerance to low temperatures (Baroudy and Elliott, 1994). Hein et al. (2012) and Reist et al. (2006) indicated negative impact of high temperatures on Arctic char surviving and migration patterns. Moreover, because of circumpolar distribution and the northernmost range comparing to other fish species, the opportunity of Arctic char to expand its range northward in response to climate warming is limited (Klemetsen et al., 2003; Hein et al., 2012). Arctic char occurs in species-poor lakes and is sensitive to species interactions (Klemetsen et al., 2003; Hein et al., 2012). The arrival of southern species (e.g. atlantic salmon, *Salmo salar*) resulting from on-going climate change, could displace Arctic char in its current habitats (Vincent et al., 2013). As suggested by Chu et al. (2005), only glaciers' recession can create new habitats for this species.

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